PEARSON ISLAND EXPEDITION 1969. — 3. CONTRIBUTIONS TO THE LAND FLORA

by D. E. SYMON*

Summary

Further additions to the Fungal, Moss and Angiosperm flora of Pearson Islands are presented, including a first list of plants from Dorothee Island. A brief account is given of the sex ratios of *Casuarina stricta* Ait. Comparisons of photographs taken after an interval of 46 years are made for 8 sites on Pearson Island.

Introduction

The first expedition to the Pearson Islands was from the 5th to 12th January 1923. During this time a collection of 52 species of vascular plants was made (Osborn 1923). The author noted that it was probably incomplete as far as herbaceous plants are concerned.

The second major collection (Specht 1969) was made by Specht between 10th and 23rd February 1960. Every effort was made to obtain a complete collection of species so that this could be compared with the original 1923 list. He presented a comparison of the two collections in his Appendix I and brought the nomenclature up to date. Specht was able to add 9 species not collected by Osborn but was unable to collect 10 species previously found. These omissions are nearly all annuals such as *Triglochin muelleri, Bulbinopsis semibarbata, Vulpia bromoides*, though it did include a few shrubs (e.g. *Westringia rigida*) or perennials (e.g. *Nicotiana suaveolens*). Specht's visit was slightly later in the year than the first one and this could account for some of these ommissions.

No effort was made during the 1969 expedition to make a third comprehensive collection of all plants on the island. Instead a selective collection was made of any apparent new records and a number of soil scrapes were brought back with the intention of germinating any seeds present. It was hoped that a number of small ephemerals might be grown that would normally have died by January.

Twenty samples of surface soil from varied sites were collected into plastic bags. On return to Adelaide, and after picking out the coarser material the soil was spread on the surface of sterilised soil and lightly covered with peat moss. A second sowing of selected samples was also made by Dr. Hj. Eichler a year later, who obtained all the species found in the first sowing and added at least two more.

All the scrapes produced some plants, with dense germination in several samples. Some species occurred repeatedly in the collections. *Apium prostratum* in 12, *Parietaria debilis* (not previously recorded) in 6, *Plantago varia* in 7, *Vulpia bromoides* in 6, *Agrostis avenacea* in 7, *Hydrocotyle comocarpa* (not previously recorded) in 4, and these species are obviously widespread. It is possible that if the soil samples were given more varied conditions for the germination of the seeds they contain, e.g. flooding or a range of temperatures, that yet more species may be grown, as some annuals known to be present, e.g. *Centrolipsis* spp., *Sonchus* sp. have not been germinated to date.

All specimens of Angiosperms have been deposited in Herbarium ADW.

Additions to the Flora of Pearson Island

Fungi. During the 1969 Expedition the following Fungi were collected. All have been identified by Dr. P. H. B. Talbot and deposited at the Waite Agricultural Research Institute.

Bovista brunnea Berk.
Geastrum fenestriatum (Pers.) Fischer
Geastrum velutinum (Morgan) Fischer
Mycenastrum corium (Guers.) Desv.
Fomes sp.

Musci. The following mosses were collected and have all been identified by Mr. L. D. Williams of Meningie; specimens are deposited in the State Herbarium (AD).

Barbula australasiae (Hook. & Grev.) Brid. (*Symon* 183).
Bryum campylothecium Tayl. (*Symon* 170, 174, 177, 180, 184).
Bryum pachytheca C.M. (*Symon* 172, 175).
Campylopus introflexus (Hedw.) Mitt. (*Symon* 170, 173, 179).

*Waite Agricultural Research Institute, Glen Osmond, S. Aust. 5064.

Fabronia leptura (Tayl.) Broth. (*Symon* 178, 182).
Grimmia laevigata (Brid.) Brid. (*Symon* 181).
Sematophyllum homomallum (Hpe.) Broth. (*Symon* 177).
Tortella calycina (Schwaegr.) Dix. (*Symon* 171.)
Triquetrella papillata (H. J. & W.) Broth. (*Symon* 176).

Angiosperms.

Zosteraceae. *Heterozostera tasmanica* (Martens) Den Hartog, collected by Mrs. J. Watson at North Bay at 26-27 m (85-90 ft.) deep.
Posidoniaceae. *Posidonia australis* Hooker f., collected by Mrs. J. Watson at North Bay at 15 m (50 ft. deep).
Euphorbiaceae. *Beyeria leschenaultii* (DC.) Baill.
Primulaceae. *Samolus repens* (Forst.) Pers.
Gentianaceae. *Erythraea australis* R. Br.
Solanaceae. *Solanum nigrum* L.

Records from germinations from soil.

Urticaceae. *Parietaria debilis* G. Forst.
Caryophyllaceae. *Minuartia* sp. (not yet identified). *Sagina apetala* Ard. *Sagina maritima* Don ex Sm. & Sow. *Spergularia* sp. (not yet identified).
Brassicaceae. *Hymenolobus procumbens* (L.) Nuttall ex Shinz. & Thell.
Apiaceae (Umbelliferae). *Hydrocotyle comocarpa* F. Muell. *Daucus glochidiatus* (Labill.) Fisch. Mey. et Avé-Lall.
Rubiaceae. *Galium murale* (L.) All.
Asteraceae (Compositae). *Brachyscome iberidifolia* Benth. *Cotula vulgaris* Levtns. *Gnaphalium involucratum* Forst. f. *Senecio minimus* var. *picridioides* (Turcz.) Belcher. *Stuartina muelleri* Sond.

Records from Dorothee.

The following plants were collected from the southern island of Dorothee and constitute the first list of plants from that island.

Poaceae (Gramineae). *Agropyron scabrum* (Labill.) Beauv. *Agrostis avenacea* Gmelin. **Distichlis distichophylla* (Labill.) Fassett.
Liliaceae. *Bulbinopsis semibarbata* (R. Br.) Borzi. *Dianella revoluta* R. Br.
Urticaceae. *Parietaria debilis* G. Forst.
Chenopodiaceae. *Atriplex cinerea* Poir. *Atriplex paludosa* R. Br. *Enchylaena tomentosa* R. Br. *Rhagodia baccata* (Labill.) Moq. *Rhagodia crassifolia* R. Br. *Threlkeldia diffusa* R. Br.
Aizoaceae. *Carpobrotus aequilaterus* (Haw.) N. E. Brown. *Disphyma australe* (Ait.) N. E. Brown. *Tetragonia amplexicoma* (Miq.) Hook. f.
Portulacaceae. *Calandrinia calyptrata* Hook. f.
Caryophyllaceae. *Sagina maritima* Don ex Sm. & Sow. *Scleranthus pungens* R. Br. *Spergularia* sp. (not yet identified).
Brassicaceae (Cruciferae). *Hymenolobus procumbens* (L.) Nuttall ex Schinz. & Thell. *Lepidium foliosum* Desv.
Mimosaceae. **Albizzia lophantha* (Willd.) Benth.
Geraniaceae. *Pelargonium littorale* Huegel.
Zygophyllaceae. *Nitraria schoberi* L.
Rutaceae. *Correa reflexa* var. *coriacea* Wilson.
Sapindaceae. *Dodonaea viscosa* Jacq.
Malvaceae. *Lavatera plebeia* var. *tomentosa* Hook. f.
Frankeniaceae. *Frankenia pauciflora* DC.
Apiaceae (Umbelliferae). *Apium prostratum* Labill. ex Vent. *Hydrocotyle comocarpa* F. Muell.
Epacridaceae. *Leucopogon parviflorus* (Andr.) Lindl.
Solanaceae. *Lycium australe* F. Muell. *Nicotiana maritima* Wheeler.
Plantaginaceae. *Plantago varia* R. Br. sens. lat.
Asteraceae (Compositae). *Calocephalus browni* (Cass.) F. Muell. *Ixiolaena supina* F. Muell. *Olearia axillaris* (DC) F. Muell. ex Benth. *Senecio lautus* Forst. f. ex Willd.

Distichlis distichophylla and *Albizzia lophantha* have not yet been found on Pearson Island and are new records for the group of islands.

The occurrence of *Albizzia* was of particular interest as nowhere is it now common on the mainland and the dense stand here in a ravine like gully may be a reflection of the freedom from grazing that the island still enjoys. Although no quantitative measurements were made, several species were obviously widespread (e.g. *Nicotiana maritima*, *Ixiolaena supina*), and these too may reflect the freedom from grazing. It is suggested that detailed ecological studies of comparable areas on the two islands (Pearson and Dorothee) would be interesting and may reflect the influence of the wallabies on the vegetation

Sex Ratios of *Casuarina stricta* Ait.

This species of *Casuarina* is dioecious and reproduces mainly if not entirely from seeds; root suckers common in some species of *Casuarina* are rarely seen. It is considered to be sexually normal and not to produce apomictic seeds (B. A. Barlow, personal communication). Sex ratios have not previously been reported. The species is common and well developed on Hill 781 forming a woodland of trees 6-8 m (20-25 feet) high. An example may be seen in Fig. 5 though not taken on Hill 781. The male trees never bear cones though some large galls can be mistaken for cones by the inexperienced observer. The female trees retain many relatively large cones (about 3 x 3 cm) which are readily seen. It was such trees that were counted and it should be noted that a tree without cones would have been counted as male.

A count was made of the cone bearing trees growing along the slope from the shoulder above North Bay to the summit of Hill 781. The method was to inspect all the trees close to a point on the transect.

Site	Trees bearing cones	Trees without cones
1. Near the lowest point on the shoulder	14	13
2. One third up the slope	11	12
3. About halfway up the slope	14	24
4. Towards top of the slope	16	23
5. Just below and about the upper boulder masses, near the summit	21	22
6. Uppermost trees	3	15

The figures show an overall sex ratio of 79 female trees to 109 male trees and they suggest an increase in the number of male trees with increasing height above sea level and exposure to the elements. If exposure is significant in affecting the survival or fertility of the female trees it may account for the rather high count of female trees at site 5 which was at the base of, and to some extent in, the lee of the massive granite outcrop and therefore in a more protected site.

Changes in the Vegetation 1923-1969

During the 1923 expedition T. G. B. Osborn took a number of photographs of various parts of Pearson Island and made notes on the vegetation of each site. The negatives, prints and notes have all been preserved. Efforts were made in 1969 to rephotograph as many of these sites as precisely as possible and to examine them for signs of vegetational change in the intervening 46 years. Sixteen sites were rephotographed and a selection of 8 pairs of comparisons is presented here. Reference can be made to Twidale (1971) for a description and map of Pearson Island.

Discussion

Some of the most obvious changes on the Island, occurring in the absence of rabbits, sheep and permanent occupation by man, have been:

1. The great reduction in dead wood and dying trees.
2. Considerable changes in the *Casuarina stricta* trees.
3. The widespread advance of dense *Atriplex* stands at a number of sites.
4. The reduction in bare ground and in annual and short lived species like *Senecio lautus* and *Apium prostratum*.
5. The reduction in medium sized shrubs such as *Olearia*, *Leucopogon*, and *Rhagodia*.

The great increase in *Atriplex* at a number of sites can hardly be due to such biotic factors as the trampling of seals or the effect of penguin rookeries as suggested by Specht (1969). The changes may perhaps be due to slow, long term succession probably triggered by a catastrophe such as fire or drought. Some signs of old fires in the form of charcoal or burnt stumps were visible on the Island. Substantial changes in grazing pressure could occur if the Wallaby population changed very much but as the increase in *Atriplex* in particular has also occurred on south section as well as north section and the former has been free of Wallabies, this seems an unlikely explanation.

After a fire one could expect much bare ground, perhaps scorched and dead trees, followed by subsequent invasions by annuals and short lived shrubs which gradually give place to longer lived shrubs, and the accumulation of dry matter finally precipitating further fire hazards. Such cycles can be seen on the mainland even in relatively arid areas and seem a possible explanation of the very great changes that have occurred on this virgin site. The effects of seasonal or cyclic climatic change or the effects of varying number of wallabies, penguins and seals are not known.

The original negatives and annotated prints by Professor T. G. B. Osborn are deposited in the Botany Department of the University of Adelaide and were kindly made available by Professor Osborn. The 1969 photographs will

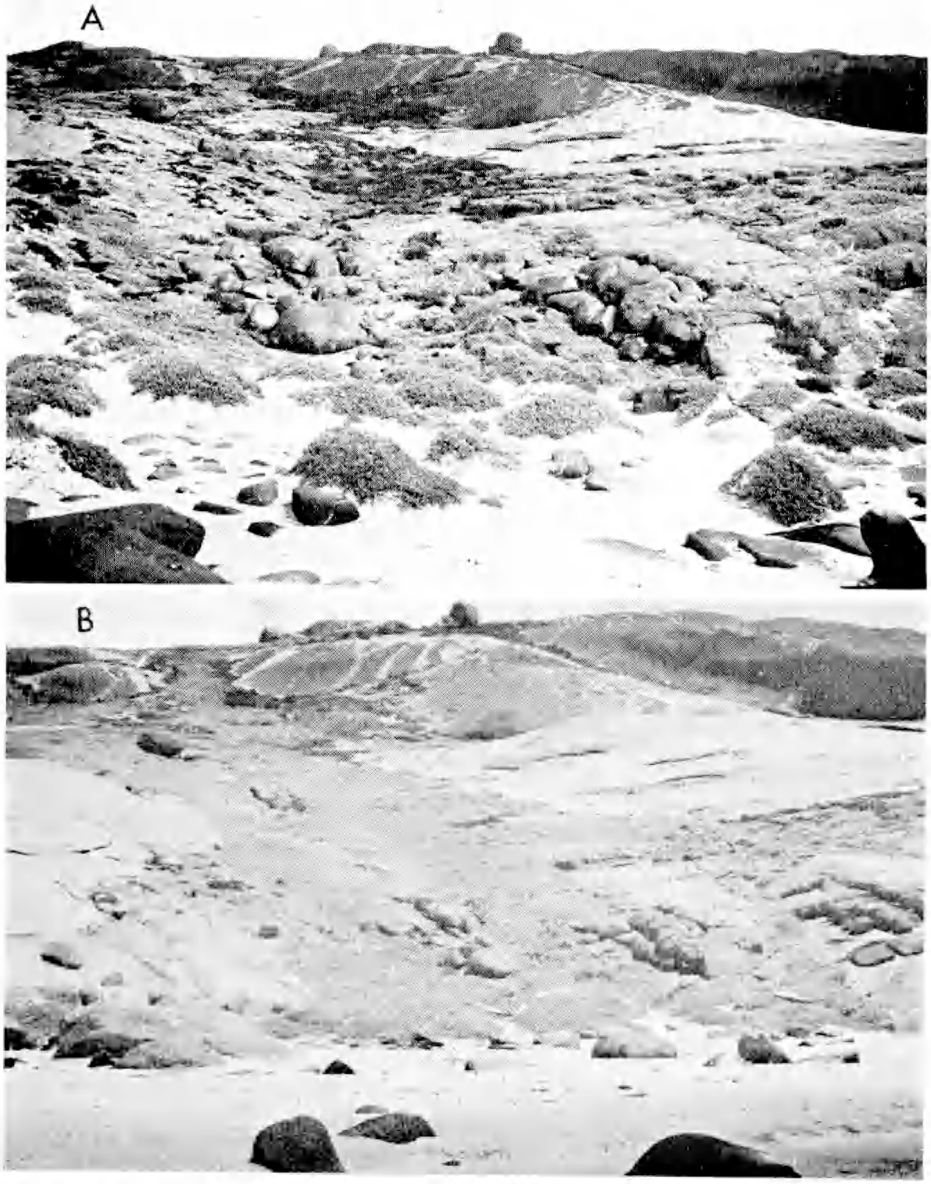

Fig. 1. A in 1923, B in 1969. Middle section from the sandy landing place, looking northwest to the summit. The *Atriplex cinerea* in the foreground has obviously become denser and the shrubberies at the base of the granite outcrops have been greatly reduced.

Fig. 2. A in 1923, B in 1969. North Bay on north section, from near the summit of East Hill.

There appears to be a reduction in dead timber, and this was also evident by inspection at other places on the Islands. There has been almost complete removal of the dead and dying *Melaleuca* along the small creek-line in the centre valley. There has been an increase in the *Atriplex paludosa* (pale) and a reduction in *Rhagodia crassifolia* (dark). Compare these also with the next pair of photographs.

Fig. 3. A in 1923, B in 1969. From the slope above North Bay, looking east to the base of East Hill.

The *Melaleuca* to be seen in the earlier photograph has now almost completely disappeared except for a little dead wood. The great reduction in *Rhagodia crassifolia* (dark hummocks) and the filling of open ground by *Atriplex paludosa* is evident. The more erect dark shrubs in the foreground of 3B are *Arthrocnemum halocnemoides*.

Fig. 4. A in 1923, B in 1969. From the slope above Eastern Cove looking up the slope to the col joining East Hill with Hill 781. Professor T. G. B. Osborn comments that the site has rapid drainage and much bare ground. See also the two previous photographs. Owing to different camera fields, the right hand edge of the 1923 photograph could not be included in the 1969 photograph. Note the almost complete replacement of the sprawling *Rhagodia crassifolia* (dark mounds) by the now dense *Arthrocnemum halocnemoides*, the great reduction of open ground, the increase in *Atriplex paludosa* on the right and the reduction in number of *Casuarina stricta* trees on the skyline.

Fig. 5. A in 1923. B in 1969. North section looking towards the summit of East Hill from the col joining East Hill and Hill 781. The marked reduction in dead wood is evident in the foreground and the middle distance. There has been a loss of the larger shrubs, e.g. the one (*Melaleuca lanceolata?*) growing on the large rounded boulder in the middle distance, though the *Correa rubra*, a little to the right, survives. There has been considerable advance in the *Atriplex paludosa* which is not visible in the earlier photograph and which has largely replaced the *Rhagodia crassifolia* in the foreground. There has been a considerable change in the tree population of *Casuarina stricta* though some individuals can be recognised, e.g. the tree in front of the central split tor, and the tree to the left of the middle tor now leaning and partly hidden in the 1969 photograph).

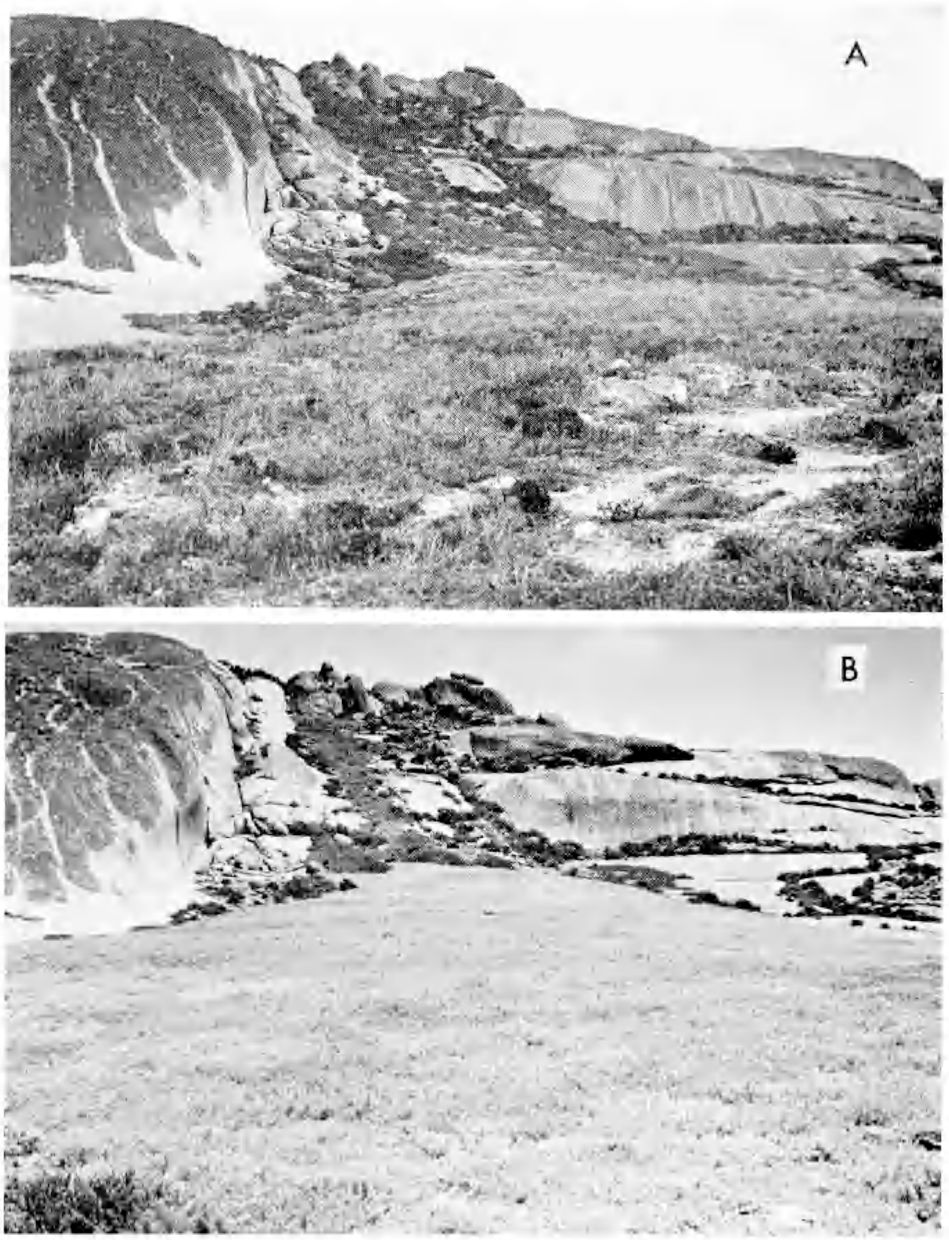

Fig. 6. A in 1923. B in 1969. Middle section, looking northwest to the summit up from the calcarenite plateau. From the foreground Professor T. G. B. Osborn lists *Senecio lautus*, *Apium prostatum*, *Enchylaena tomentosa* and *Lepidium foliosum*, and the bare ground is also evident. These shrubs have been almost completely replaced by dense *Atriplex cinerea*. This was one of the most striking examples of the increase in *Atriplex* on the Island.

Fig. 7. A in 1923, B in 1969. Middle section, northeast edge of the calcarenite plateau looking W to the summit. The changes listed under Fig. 6 are all evident here. In addition, the *Olearia ramulosa* growing at the junction of the calcarenite and the granite has largely disappeared and there has been a general reduction in shrubs. The lichen patterns seen on the main granite masses have possibly increased in the foreground. Where did the large rock present on the middle left skyline in 1969 come from?

Fig. 8. A in 1923, B in 1969. North section, lower slopes of East Hill from the south. The rather open stand of *Atriplex paludosa* in the foreground is now very dense. The *Olearia*, *Leucopogon* and *Correa* shrubs on the slope have been reduced and invaded by *Atriplex*. The *Casuarina* trees on the skyline have been reduced though some (such as the large dense tree to the right in 1923) may persist as a sparse relic in 1969. Almost all the trees at the base of the large low rocks in the centre have gone.

be added to the collection. The availability of these relatively early, well annotated photographs, and the island's freedom from sheep, rabbits and stock make Pearson Island an almost unique site in South Australia for the study of long term natural changes in the flora, and every effort should be made to keep interference by man in the islands to a minimum.

Acknowledgements

I am most grateful for the assistance of the Department of Fisheries and Fauna Conservation and the Council of the Royal Society of South Australia in enabling me to take part in this Expedition, and also to Professor T. G. B. Osborn for letting me have access to his film negatives and original notes from the 1923 Expedition.

References

Osborn, T. G. B. (1923).—The flora and fauna of Nuyts Archipelago and the Investigator Group. No. 8. The ecology of Pearson Islands. *Trans. R. Soc. S. Aust.* 47, 97-118.

Specht, R. L. (1969).—The Vegetation of the Pearson Islands, South Australia; a re-examination, February, 1960. *Trans. R. Soc. S. Aust.* **93**, 143-152.

Twidale, C. R. (1971).—Pearson Island Expedition 1969.—2. Geomorphology. *Trans. R. Soc. S. Aust.* **95**, 123-130.